

What is claimed is:

1. A liquid crystal display device comprising:

5 a liquid crystal display panel having picture elements which are arranged at intersection points of a plurality of data bus lines and a plurality of gate bus lines in a matrix;

a data driver for supplying image data to the data bus lines in unit of picture element;

10 a gate driver for driving the picture elements into their operation states sequentially via the gate bus lines in synchronism with a horizontal synchronizing signal;

15 an input controlling portion for controlling the image data displayed on the liquid crystal display panel by supplying a display control signal, which contains at least the image data and the horizontal synchronizing signal, to the data driver and the gate driver; and

20 a reference voltage generating portion for generating a reference voltage, which is applied to the picture elements with polarities on the liquid crystal display panel, based on the image data;

25 wherein the input controlling portion monitors a correlation between a change period of a display pattern of the image data and a polarity inverting period of the reference voltage, and then switches arbitrarily the polarity inverting period when it is

detected that the change period synchronizes with the polarity inverting period.

2. A liquid crystal display device according to claim 1, wherein the input controlling portion includes

5 an image data extracting circuit for extracting the image data sequentially,

a pattern detecting circuit for detecting a particular display pattern by counting an amount of change of extracted image data and then comparing the amount of change with a specified value, and

10 an inverting period controlling circuit for generating the reference voltage having a different polarity inverting period,

the inverting period controlling circuit switches and sets the polarity inverting period based on a detection result derived by the pattern detecting circuit, and

15 the reference voltage generating portion generates the reference voltage having the polarity inverting period being switched and set, and supplies it to the data driver.

20 3. A liquid crystal display device according to claim 1, wherein the input controlling portion includes an input data latching circuit which has a plural-stage flip-flops for holding the image data temporarily, and

25 the image data extracting circuit includes logic gates which receive input/output data of the flip-flops

of the input data latching circuit, output predetermined logics, and extract change states of adjacent image data.

5 4. A liquid crystal display device according to claim 1, wherein the reference voltage generating portion normally selects a predetermined polarity inverting period, but selects the polarity inverting period at random out of a group of other inverting periods which are prepared previously when the
10 particular display pattern or a period synchronizing state is decided.

15 5. A liquid crystal display device according to claim 1, wherein the inverting period controlling circuit includes at least an inverting system in unit of dot and an inverting system in unit of a data bus
20 line or a gate bus line as a polarity inverting system of the reference voltage applied to the picture elements, and then switches and sets arbitrarily the polarity inverting system when the particular display pattern or a period synchronizing state is decided.

25 6. A display panel driving method of receiving image signals, a horizontal synchronizing signal and a vertical synchronizing signal, or an enable signal, and then supplying data signals, which are generated from the image signals to change into a positive polarity and a negative polarity, to data bus lines of a display panel, comprising the step of:

storing polarity patterns in a polarity pattern
storing portion; and

detecting a polarity of data signals, which are
supplied to the data bus lines, in compliance with the
5 polarity patterns read from the polarity pattern
storing portion.

7. A display panel driving method according to
claim 6, further comprising the step of:

storing a plurality of polarity patterns in the
10 polarity pattern storing portion; and

detecting the polarity of the data signals, which
are supplied to the data bus lines, by outputting only
one polarity pattern from the polarity pattern storing
portion according to the image signals.

15 8. A display panel driving method according to
claim 7, further comprising the steps of:

outputting any one polarity pattern of the
plurality of polarity patterns from the polarity
pattern storing portion, to supply the data signals
20 with the polarity according to the polarity pattern to
the data bus lines; and

detecting whether or not the polarity pattern
being output from the polarity pattern storing portion
is similar to the image signals, to switch the polarity
25 pattern which is output from the polarity pattern
storing portion based on a detection result.

9. A display panel driving method according to

claim 8, wherein the step of detecting whether or not the polarity pattern being output from the polarity pattern storing portion is similar to the image signals counts a coincidence number of times between them in a unit time or every predetermined data number, and compares a counted value with a predetermined value.

10. A display panel driver circuit for receiving image signals, a horizontal synchronizing signal and a vertical synchronizing signal, or an enable signal, and then supplying data signals, which are generated from the image signals to change into a positive polarity and a negative polarity, to data bus lines of a display panel, comprising:

a polarity pattern storing portion for storing a polarity pattern;

a temporarily storing portion for storing the polarity pattern being output from the polarity pattern storing portion, and then outputting it as a polarity signal; and

a data signal outputting portion for receiving the image signal and outputting the data signal with a polarity according to the polarity signal output from the temporarily storing portion.

11. A display panel driver circuit according to claim 10, wherein the polarity pattern storing portion stores data of two frame bit number, which consist of data for the odd-numbered frame and data for the even-

numbered frame which has inverted logical values of the data for the odd-numbered frame, as a set of polarity patterns.

5 12. A display panel driver circuit according to claim 11, further comprising:

10 a polarity pattern switching portion for detecting whether or not the polarity pattern being output from the polarity pattern storing portion is similar to the image signal, and then switching the polarity pattern which is output from the polarity pattern storing portion based on a detection result.

13. A display panel driver circuit according to claim 10, further comprising:

15 a temporarily storing portion for storing the polarity pattern for one horizontal synchronization period output from the polarity pattern storing portion and outputting it as the polarity signal;

20 a polarity signal inverting portion for inverting the polarity of the polarity signal in synchronism with the horizontal synchronizing signal; and

 a data signal outputting portion for receiving the image signal and outputting the data signal with a polarity according to the polarity signal being output from the temporarily storing portion.

25 14. A display panel driver circuit according to claim 13, wherein the polarity pattern storing portion stores plural sets of polarity patterns, while using

the data with the bit number for horizontal synchronization period as a set.

15. A display panel driver circuit for receiving image signals, a horizontal synchronizing signal and a vertical synchronizing signal, or an enable signal, and then supplying data signals, which are generated from the image signals to change into a positive polarity and a negative polarity, to data bus lines of a display panel, comprising:

10 a polarity pattern generating portion for generating a plurality of different polarity patterns;

a selection signal generating portion for generating a selection signal to decide a polarity pattern being output from the polarity pattern generating portion;

15 a polarity signal inverting portion for inverting logical values of respective bits of the polarity pattern, which is output from the polarity pattern generating portion, every one horizontal synchronization period and one vertical synchronization period and outputting them; and

20 a data signal outputting portion for receiving the image signal and outputting the data signal with a polarity according to the polarity signal.

25 16. A liquid crystal display device comprising:

(i) a liquid crystal display panel;

(ii) a data driver circuit including

a polarity pattern storing portion for storing a polarity pattern,

5 a temporarily storing portion for storing the polarity pattern output from the polarity pattern storing portion, and then outputting it as a polarity signal, and

10 a data signal outputting portion for receiving the image signal, and then outputting the data signal with a polarity according to the polarity signal output from the temporarily storing portion to the liquid crystal display panel; and

15 (iii) a gate driver circuit for supplying a scanning signal to the liquid crystal display panel at timings which are in synchronism with a horizontal synchronizing signal and a vertical synchronizing signal.

17. A liquid crystal display device comprising:

(i) a liquid crystal display panel;

(ii) a data driver circuit including

20 a polarity pattern generating portion for generating a plurality of different polarity patterns,

a selection signal generating portion for generating a selection signal to decide a polarity pattern being output from the polarity pattern
25 generating portion,

a polarity signal inverting portion for inverting logical values of respective bits of the

polarity pattern, which is output from the polarity pattern generating portion, every one horizontal synchronization period and one vertical synchronization period and outputting them, and

5 a data signal outputting portion for receiving the image signal, and then outputting the data signal with a polarity according to the polarity signal; and

10 (iii) a gate driver circuit for supplying a scanning signal to gate bus lines of the liquid crystal display panel at timings which are in synchronism with a horizontal synchronizing signal and a vertical synchronizing signal.

15 (18) A display panel driving method of receiving image signals, a horizontal synchronizing signal and a vertical synchronizing signal, or an enable signal, and then supplying data signals, which are generated from the image signals to change into a positive polarity and a negative polarity, to data bus lines of a display panel, comprising the steps of:

20 partitioning a display screen into a plurality of blocks;

 calculating a rate of flicker patterns contained in at least one block; and

25 changing a polarity pattern, which detects a polarity of the data signal supplied to the data bus lines, from a first polarity pattern to a second

polarity pattern when the rate exceeds a predetermined value.

19. A display panel driving method according to claim 18, wherein the polarity pattern is changed into the second polarity pattern when a number of blocks out of a plurality of blocks, in which the rate of flicker patterns is in excess of the predetermined value, exceeds a predetermined value.

20. A display panel driving method according to claim 18, wherein, after the polarity pattern is changed from the first polarity pattern to the second polarity pattern, the polarity pattern is returned to the first polarity pattern when the rate of flicker patterns contained in the block over a predetermined frame period is less than a predetermined value.

21. A display panel driving method according to claim 18, wherein partition positions of the blocks are changed frame by frame.

22. A display panel driving method according to claim 18, wherein the flicker patterns are detected every image signals for at least two pixels which are adjacent in a horizontal direction.

23. A display panel driver circuit for receiving image signals, a horizontal synchronizing signal and a vertical synchronizing signal, or an enable signal, and then supplying data signals, which are generated from the image signals to change into a positive polarity

and a negative polarity, to data bus lines of a display panel, comprising:

5 an image signal detecting portion for receiving the image signals and then detecting turned-ON picture elements and turned-OFF picture elements;

 a flicker pattern detecting portion for detecting whether or not a pattern corresponds to flicker patterns, based on a detection result of the image signal detecting portion;

10 a dynamic range designating portion for designating a dynamic range;

 a flicker information amount detecting portion for calculating a rate at which the patterns, which are detected by the flicker pattern detecting portion as flicker patterns, are contained in the dynamic range which is designated by the dynamic range designating portion;

20 a driving mode selecting portion for outputting a signal to decide the polarity pattern of the data signal, based on a detection result of the flicker information amount detecting portion; and

25 a polarity pattern varying portion for changing a polarity pattern, which detects a polarity of the data signal supplied to the data bus lines, from a first polarity pattern to a second polarity pattern according to an output of the driving mode selecting portion.

24, A liquid crystal display device comprising:

(i) a liquid crystal display panel;

(ii) an image signal detecting portion for receiving the image signals and then detecting turned-ON picture elements and turned-OFF picture elements;

5 (iii) a flicker pattern detecting portion for detecting whether or not a pattern corresponds to flicker patterns, based on a detection result of the image signal detecting portion;

(iv) a dynamic range designating portion for
10 designating a dynamic range;

(v) a flicker information amount detecting portion for calculating a rate at which the patterns, which are detected by the flicker pattern detecting portion as flicker patterns, are contained in the dynamic range
15 which is designated by the dynamic range designating portion;

(vi) a driving mode selecting portion for outputting a signal to select the polarity pattern of the data signal, based on a detection result of the flicker information amount detecting portion; and
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(vii) a polarity pattern varying portion for changing a polarity pattern, which detects a polarity of the data signal supplied to the data bus lines, from a first polarity pattern to a second polarity pattern according to an output of the driving mode selecting
25 portion.

25. A liquid crystal display device according to

claim 24, further comprising:

an exception pattern detecting portion for
detecting patterns, which are to be excepted from the
flicker patterns, from the patterns which are detected
5 by the flicker pattern detecting portion as the flicker
patterns.